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A Comparative Study of Non-Dairy Cream Based on The Type of Leguminosae Protein Source in Terms of Physico Chemical Properties and Organoleptic

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Abstract

Quality non-dairy creamer was influenced by the color and the stability of emulsion. Non dairy creamer used a natural emulsifier ie protein concentrates derived from the class of Leguminosae. This study aimed to assess the effect of the concentration of sodium caseinate and protein concentrate source on the quality (physico-chemical and organoleptic). This study used two factors were sodium caseinate (1.5%, 2.0% and 2.5%) and the protein concentrate source (leucaena, green beans and red beans). The results showed the use of 2.0% sodium caseinate and protein concentrates of 1% green beans produced non-dairy creamer most preferred who produced 5.22 % moisture, solubility protein 0.29 g/mL, bulk density 0.6218 g/10 mL, solubility 42.05% and 61.76% whiteness.

Peer-review under responsibility of the organizing committee of IC-FANRes 2015

Keywords: non-dairy creamer, sodium caseinate, protein concentrate, leucaena, green bean, red bean

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1. Introduction

Coffee is commonly consumed with a coffee creamer/non dairy creamer or lightener to soften the acidic taste (Pordy, 1994). The coffee cream consists of vegetable/milk fat, sodium caseinate, stabilizers, sweetener, emulsifiers, flavor and color (Ellinger, 1972). Coffee holds second position in consumption among all beverages after water, and people from all over the world consume approximately 500 billion cups annually (Prakash et al., 2002). Coffee consumption has been shown to have adverse effects on various biological markers related to coronary heart disease risk, such as serum cholesterol (Jee et al., 2001).

Instant coffee augmented the oxidative stress and it was the most effective on increasing the level of LDH. Non-dairy creamer augmented the risk of myocardial integrity and it was the most effectiveness on the levels of LDL, HDL and LDL/HDL. Instant coffee plus non dairy creamer reflected synergistic effect on increasing the oxidative stress and decreasing the glucose level. These results suggest that instant coffee and non-dairy creamer consumption has been shown to have adverse effects on various biological markers of heart suggestive of increased cardiovascular disease risk (Hanna & Elmonem 2014)

Non-dairy creamer is the product that does not make from milk and has other fats than cream as ingredients or creamer that contains cream less than 30% (Ministry of Public Health, 2000). Most of non-dairy creamer is made from coconut and palm kernel oil, available as powdered, liquid and frozen forms (Herbst, 1995) and has the major role to reduce color of coffee and tea and provides flavor (Gardiner, 1977).

The non-dairy creamer composition is influenced by a number of constituent materials of which the addition of sodium caseinate and emulsifiers to produce white color and stable emulsion when added to drinks or coffee. Treatment addition of sodium caseinate on the non-dairy creamer significantly effect on protein content, flavor and color brightness level of the product. Emulsifier was required that play a role in the establishment phase of an emulsion between the aqueous phase to the oil phase. Emulsifier concentrates can be produced from a protein which can be obtained from food ingredients that contain high protein. The food that protein rich content is of Leguminosae class. Leucaena leucocephala, green bean and red bean were examples of groups that it were protein rich levels respectively by 30-40% (Suprihatin, 2009), 22.2% (Suprapto, 1982) and 22.3% (Nutrition Directorate, Department of Health 1992).

The previous research has produced leucaena seed protein concentrate that had the protein 56.30 % (db), and it had functional properties of oil absorption capacity of 1.58 mL/g, power foam 11.56%, on the concentration of sheep rumen fluid enzyme (10 mL/100gr) and long incubation of 24 h, whereas the concentration of enzyme treatment of sheep rumen fluid (10 mL/100g) and incubation time of 48 h resulted in the best functional properties on water absorption of 3.42 mL/g, the bulk density 0.56 g/mL, power emulsion 52.75%, 6.39% moisture content (Rosida et al., 2015). Protein concentrate can be produced from the hydrolysis of leucaena seeds use enzymes of pineapple skin wastes produced protein yield of 103.90%; sheep rumen enzyme 113.77%; amylase enzyme 120.45%, 108.17% alkaline extraction and separation by membrane ultrafiltration 108% (Rosida et al., 2013b). Based on this background, the research conducted to using protein sources such as emulsifier. They can provide a real influence on the quality (physico-chemical and organoleptic) of non-dairy creamer produced.

2. Methodology

2.1. Material

The materials consists of: vegetable oil, leucaena leucocephala seed, green bean, red bean, glucose syrup, Carboxy Methyl Cellulose, sodium caseinate, dextrin

2.2. Production of protein concentrate

Suspension flour of leucaena, green beans and red beans performed by mixing (flour : Water = 10: 100 g / mL). PH suspension was adjusted to obtain optimum pH of 6.5. The suspension was heated at 100 ^{o}C for 5 minutes and then cooled to a temperature of 55 ^{o}C. Pineapple peel crude enzyme extract was added as much as 100 mg /100 g. Incubated with using a shaker water bath was at a temperature of 55 ^{o}C for 48 hours. The suspension was added to the 50 mL hot water was temperature 80 ^{o}C. The suspension was centrifuged at a speed of 2,500 rpm for 30 minutes to followed drying with a dryer cabinet at 30 ^{o}C for 20 hours

2.3. Production of non-dairy creamer

The glucose syrup 35% was dissolved to added on water 41 mL. The solution was poured slowly into the oil phase of which has been given a 1% protein concentrates which serves as an emulsifier and sodium caseinnate put each treatment 1.5%, 2%, and 2.5% were then added Carboxy Methyl Cellulose 1%. The solution was homogenized for 15 minutes to form a stable emulsion system. Emulsion was added dextrin and water (1: 3) to dried by freeze drying.

2.4. Determination of protein (Lowry et al 1951)

The analysis was performed by taking each fraction of as much as 2 mL of distilled water and 5.5 ml reagent of mixture of 2% sodium carbonate solution in 0.1 N NaOH solution and copper sulfate solution 0.5% Na-k tartaric 1% (50:1), then stirring and left for 10-15 minutes at room temperature. Furthermore, the addition of reagent Folin-Ciocalteau 0,5 mL, whipped and left for 30 minutes until a blue color was formed. Absorbance was measured at a wavelength of 650 nm. Standard curve made using bovine serum albumin solution of 0.25 mg/mL.

2.5. Bulk Density (Okezie and Bello, 1988)

The sample was introduced into a 10 ml measuring cup that known weight. Measuring cup that had a knock-sample inserted into the table > 30 times until no cavity when the sample was matched to 10 ml. Measuring cup containing the sample was then weighed. Bulk density can be calculated from the weight distribution of the sample by volume (10 ml).

$$\text{Bulk density (g/mL)} = \frac{a - b}{10}$$

Description: a : weight measuring cup containing 10 ml of sample (g)
b : weight of empty measuring cup (g)

2.6. Determination of solubility (Pomeranz & Meloan, 1978)

Initially step was determined the water content in the sample. Solubility value measurement was done by dissolving 2 grams of sample into 100 mL of water, then filtered through Whatman filter paper No. 42. Before use, the filter paper dried in an oven at a temperature of 105 ^{o}C for 30 minutes and weighed. After filtration, the filter paper containing the residue dried in an oven at a temperature of 105 ^{o}C for 3 hours, then cooled in a desiccator and weighed.

The amount of the solubility expressed in weight percentage of residues that can not be through a filter paper to the weight of the sample used. The more samples that can be dissolved in water, the greater the mass of dissolved material so that the values of % solubility are also getting bigger. Solubility values can be calculated with the following formula:

$$\text{Solubility (\%)} = \frac{1 - (c - b) \times 100\ \%}{\frac{(100 - \%\ W) \times a}{100}}$$

Description:
a = weight of the sample (g)
b = weight of filter paper (g)
c = weight of filter paper and residue (g)
W= water content of the sample (% wb)

This study was conducted using a completely randomized design (CRD). The data obtained were analyzed using analysis of variance. test Honestly Significant Difference (HSD) used to find out the difference between the treatment group

3. Result and Discussion

3.1. The levels of soluble protein

Protein concentrates from the group Leguminosae (leucaena beans, green beans and red beans) affected the levels of soluble proteins that exist in the non-dairy creamer produced. Kilara (1994) states that the polar amino acids have the following properties: having R groups are not charged and hydrophilic, and tend to be located on the outside of the protein molecule. Hydrophilic properties of the protein or able to absorb water due to the chains that have polar groups, such as carbonyl, hydroxyl, amino, carboxyl, and sulfhydryl, so that it can form hydrogen bonds with water. The number and type of polar groups are different then the protein's ability to absorb water was different (Kilara, 1994).

Table 1. amino acid Composition of Leucaena Seed Protein Concentrate

Amino acid	Result (%)
L-Aspartic	3.99
L-Glutamic	-
L-Asparagine	4.73
L-Histidine	2.43
L-serine	0.11
L-Glutamine	0.91
L-Threonin	3.60
L-Glycine	2.17
L-Arginia	1.32
L-Alanine	2.78
L-Tyrosine	1.50
L-Thryp+L-Methionine	3.39
L-Valine	1.03
L-Phenylalanine	-
L-Isoleucine	0.95
L-leucine	2.96
L-Lycine	3.25

The data amino acids showed that the highest polar amino acids present in leucaena seed while red beans contains lower amino acids polar. Figure 1 show that non-dairy creamer used green bean and red bean protein concentrates showed higher soluble protein than the non-dairy creamer of leucaena protein concentrates.

Sodium caseinate roled in providing a sense of milk (milk-taste), concentrated or gave a milky white color. In addition the sodium caseinate also served as a source of protein. In the Australian Dairy Goods (2008) stated that sodium caseinate has a protein content of 88%. The addition of sodium caseinate influences the soluble protein content in the non-dairy creamer. Therefore in this study showed the highest levels of soluble protein in the addition of 2.5% sodium caseinate.

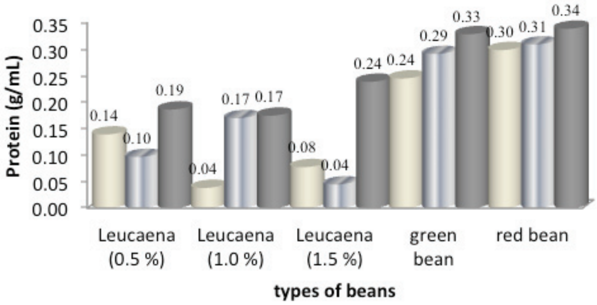

Figure 1. The levels soluble protein of non-dairy creamer

Protein concentrates have one functional property, water absorption (water holding capacity, WHC) which may affect the water content of a product. Besides Water Absorption (WHC), the water content in the non-dairy creamer was also influenced by the kinds of amino acids contained in protein concentrates are used as an emulsifier in non-dairy creamer. Suwarno (2003) states that water absorption related to the amount of polar amino acid group, such as hydroxyl, amino, carboxyl and sulfhydryl give hydrophilic properties to a protein molecule. The amount of bound water tends increase if the polarity of the protein increases.

Table 2. The composition and solubility of non dairy creamer

Protein source	Water content (%)			Solubility (%)			Oil (%)		
	Sodium Casseinate			Sodium Casseinate			Sodium Casseinate		
	1.5	2.0	2.5	1.5	2.0	2.5	1.5	2.0	2.5
Leucaena	5,41ab	5,54a	5,51ab	40,50a	31,32b	37,44c	20,82d	19,16de	29,86b
Green bean	5,23abc	5,22abc	5,43ab	32,33c	42,05a	37,15b	19,28de	19,49d	25,58c
Red bean	5,02bc	5,43ab	4,83c	41,32a	30,41c	41,47a	18,55de	16,45e	34,91a

Leucaena seeds containing polar amino acids 12.6%, non-polar amino acid of 12.4% (Sitompul, 1997). Green beans contain amino acids polar total of 11.7%, non-polar amino acid of 8.7% (Suprapto, 1982). Red beans contain polar amino acids at 4.3%, non-polar amino acid of 3.1% (Sitompul, 1997). From these data it can be seen that the leucaena seeds contains highest polar amino acids compared to the green beans and red beans in order to obtain the data analysis of the water content in the product of non-dairy creamer with leucaena concentrates protein contains an average moisture content of the highest on each addition of sodium caseinate (1.5%, 2.0% and 2.5%), whereas the non-dairy creamer products with red bean protein concentrates gained an average of the lowest water levels in each addition of sodium caseinate (1.5%, 2, 0% and 2.5%).

The sodium caseinate is also called natural amphipilic, which has a hydrophilic group and a hydrophobic (or lipophilic). It is thought to affect the results of the analysis of the water content of the non-dairy creamer that produces optimal water binding different because of the nature amphipilic of sodium caseinate (Akinshina et al., 2008; .O'Regan & Mulvihill, 2009).

Non dairy creaamer solubility of the three sources protein resulted real difference. Solubility in a food is affected by the moisture content of the product. Non-dairy creamer of leucaena protein concentrates was obtained low water content (5.41%) on the 1.5% Sodium Casseinate). Non-dairy creamer of green bean protein concentrates was obtained by low water content (5.23 %) on Sodium Casseinate 2.0% and non-dairy creamer of red bean protein concentrates was obtained by low water content (4.84%) on casseinate Sodium 2.5%. Wuryantoro and Susanto, (2014) states that the solubility associated drying temperature also affects the water content of the material, where the temperature is lower (high water content), solubility tends to be lower, because if the high water content forms clumps that material takes a relatively long to break the bonds between the particles and the ability of the product to dissolve into decline.

3.2. Oil content

In this study, non-dairy creamer used source of fat from vegetable oils (palm oil) 20%. Oil level of non-dairy creamer was obtained ranged 16.45% - 34.91%. Oil content in the non-dairy creamer is also influenced by the addition of sodium caseinate resulting in increased levels of fat. According to the Australian Dairy Goods (2008) states that oil content of 1.5% sodium caseinate. In addition to the non-dairy creamer products also used protein concentrates from three types of legumes (leucaena beans, green beans and red beans). The oil content of non-dairy creamer is affected by the non-polar amino acids from protein concentrates are able to bind oil and the oil content of the flour beans,

The highest non-polar amino acid is in Leucaena (12.4%), followed by green beans (8.7%), and red beans (3.1%). While the initial oil content of leucaena seed flour amounts to 3.19% (Rosida et al., 2013a), green bean flour amounts to 1.66% (Apriani et al., 2011) and red bean flour by 2.4% (Nuraidah, 2013). It was thought to affect the results of the analysis of oil content in the non-dairy creamer products where the higher non-polar amino acids in the protein concentrates the stronger the holding capacity of oil. Therefore, the analysis of oil content in the non-dairy creamer of leucaena protein concentrates contained higher levels of oil than non-dairy creamer using red bean protein concentrates.

The amount of oil content in the non-dairy creamer can affect the viscosity. The desirable range of viscosity of the oil for the production of non-dairy creamer can be varied depending upon types of oil used. As the formula of non-dairy creamer involves using of many ingredients including emulsifiers, texturizing agents, milk powder, sodium casienate, glucose syrup, appropriate synthetic color, flavor and water, the viscosity of the slurry can be adjusted appropriately before being spray dried (Katsri, 2014)..

The mixtures of hydrogenated Palm kernel oil (PKO) and cold-pressed Rice bran oil (RBO) have various physical and chemical properties in terms of viscosity, color, trans-fat, fatty acid composition, γ-oryzanol, α-tocopherol and antioxidant activity. The hydrogenated PKO:cold-pressed RBO mixtures of 80-100:20-0 contained trans-fat, therefore, they should not be selected for further utilization in food products. Substitution of hydrogenated PKO by cold-pressed RBO from 30-100% would be suitable for food applications in terms of nutrition and health (Katsri, 2014). This fatty acid profile gives PKO a solid consistency at cool ambient temperatures below 30°C (Rossell, 1985). PKO is a widely used ingredient for production of non-dairy creamer (Kelly, 1999).

3.3. Bulk Density

Basically, bulk density of a material was influenced by the moisture content of material. The lower moisture content of the material results the greater bulk density. The results of the water analysis was obtained by the average value of the lowest in the non-dairy creamer with protein concentrates of leucaena was 5.41%, followed by in the non-dairy creamer with green bean was 5.22% and red bean was 4.83%.

The bulk density calculated based on the volume of a particular product. Granules or droplets greater cause greater volume needed than small grain flour. Bulk density tendency is inversely proportional to the density of water content, the lower the water content, the higher the bulk density. The lower water content, the force of attraction between the particles will be stronger so that the empty space between the particles will be smaller (low porosity) which causes the greater bulk density. Suspected granules or droplets on each non-dairy creamer are not the same. This affects the weight of the products so that the calculation results bulk density varies between each type of protein source (Wati, 2003).

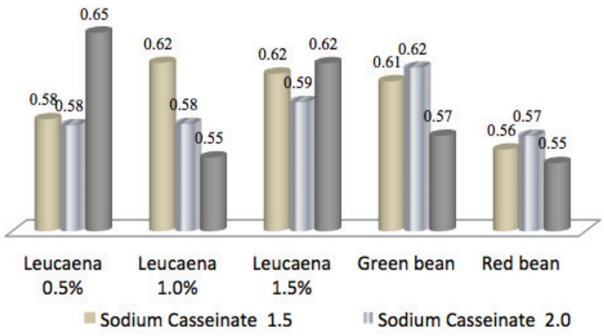

Figure 2. Bulk density (g/10 mL) of *non-dairy creamer*

3.4. Non-Dairy Creamer Organoleptic

Consumer's sense is a parameter in assessing the taste of the food product. Parameter sense is determining whether a food product is acceptable to consumers. It is generally agreed that there are only four basic tastes or flavors real, sweet, bitter, sour and salty (Fever, 1997).

The use of green bean protein concentrates gave a sense of the most preferred protein concentrates panelist than leucaena. A level of the coffee drink non-dairy creamer declines with different types of protein concentrates was used. On the use of concentrates protein green beans and red beans still like the taste of the coffee that is blended with non-dairy creamer, while the use of concentrates protein leucaena caused distaste panelists for coffee mixed with non-dairy creamer. Creamer flavor also influenced by the type of amino acids that make up proteins are used as emulsifier protein concentrates. Many savory peptides that make up a protein will provide a more savory flavor.

The average yield degrees of whiteness non-dairy creamer were between 52.3729% - 62.8971%. The highest whiteness level was obtained in non-dairy creamer using red bean protein concentrates in the amount of 62.8971% while the lowest was in the white-degree non-dairy creamer using protein concentrates leucaena (52.3729%). This is due to the basic ingredients of the red bean protein concentrates was bright white, the leucaena concentrates was yellow and green beans concentrate was greenish white. Beside the level of whiteness in the non-dairy creamer is also influenced by the addition of sodium caseinate, protein levels that can produce Maillard reaction caused brown color.

Table 5. Whiteness of non dairy creamer

protein	Sodium casseinat(%)	L*	a*	b*	whiteness
	1.5	63,95	28,65	12,15	52,37
Leucaena	2.0	66,7	23,55	11,7	57,50
	2.5	66.0	26,45	10,95	55,53
	1.5	66,5	19,2	14,95	58,49
green bean	2.0	68,1	15,9	13,85	61,76
	2.5	66,05	14,95	15,85	59,66
	1.5	66,95	15,25	16,95	59,85
red bean	2.0	66,65	14,85	14,7	60,64
	2.5	68,95	15,35	13,3	62,90

The higher the proportion of sodium caseinate is used, that caused the higher the brightness level of the product (Safitri et al., 2013). In this study did not use any additional coloring materials such as commercial creamer on the market added food coloring ingredients such as Beta Carotene CI 75 130, anato CI 75 120, and so forth.

Tabel 6. Coffee Drinks non-Dairy Creamer organoleptic

treatment		Total Rank taste	Total Rank Color	Total Rank viscosity	Total Rank Milk like taste
Protein source	*Sodium Caseinate* (%)				
Leucaena	1,5	112	108	100	111
	2,0	135,5	110,8	106	131,5
	2,5	110,5	124	119	133,5
Green bean	1,5	128,5	114,5	87	134,5
	2,0	169	140	154,5	135
	2,5	111	115,5	129	109
Red bean	1,5	115,5	109,5	74	104
	2,0	120,5	119,5	144	125,5
	2,5	111,8	123	124	114

The viscosity organoleptic test of coffee drink with non-dairy creamer was preferred by the panellists on the use of green bean protein concentrates with sodium caseinate 2.0%, while the use of red bean protein concentrates and sodium caseinate 1.5% showed the lowest preference level. The higher the concentration the addition of sodium caseinate, the more concentrated coffee beverage produced

4. Conclusion

In the current study green bean protein concentrates 1% and 2.0% sodium caseinate produced non-dairy creamer best with criteria: protein 0.2905 g/mL, oil 19.49 %, bulk density 0.62 g/10 mL, solubility 42.05%, whiteness 61.76%, average ranking of 169 flavors, colors 140, a viscosity 154,5 and a milk-like taste of 135.

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References

Akinshina, A., Ettelaie, R., Dickinson, E., Smyth, G., 2008. Interactions Between Adsorbed Layers of A_{s1}-Casein with Covalently Bound Side Chains: A Self-Consistent Field Study. Biomacromolecules 9, 3188–3200

Apriyani, R.S., Arpah, M., Setyadjit., 2011. Formulation of Composite Flour: Talas, Green Beans and Bananas In Making Baked Brownies. Mutu dan Keamanan Pangan 2(1), [http://digitapustaka.wordpress.com/]. Accessed January 16, 2015.

Australian Dairy Goods., 2008. Spesification for Sodium Caseinate. Australian Dairy Goods Pty Ltd. Departemen Health. 1992. List of Food Composition . Jakarta

Ellinger, R.H., 1972. Phosphates as Food Ingredients. CRC Press, Cleveland,OH.

Gardiner, D.S., 1977. Nondairy creamer composition. U.S. Patent. Patent Number 4,046,926.

Hanna, L.S., Abd Elmonem, H.A., 2014. Evaluation of Cardiac Biomarkers In Albino Rats Consumed Instant Coffee and Non-Dairy Creamer. Journal of American Science 10(5), 96-101

Jee, S.H., He, J., Appel, L.J., Whelton, P.K., Suh, I., Klag, M.J., 2001. Coffee Consumption and Serum Lipids: A Meta-Analysis of Randomized Controlled Clinical Trials. Am J Epidemiol. 153, 353-362.

Herbst, S.T., Wang., 1995. Encyclopedia. Barron's Educational Series, London.

Katsri K., Noitup, P., Junsangsree, P., Singanusong, R., 2014. Physical, Chemical and Microbiological Properties of Mixed Hydrogenated Palm Kernel Oil and Cold-Pressed Rice Bran Oil as Ingredients In Non-Dairy Creamer. Songklanakarin J. Sci. Technol. 36(1), 73-81.

Kelly P.M., Oldfield, D.J., and Teehan, C.M., 1999. CoffeeStability of Agglomerated whole Milk Powder and other Dairy Creamer Emulsion (Coffee-Stability of dried Creamer), The Dairy Products Research Centre,Moorepark, Fermoy, Co. Cork, Ireland.

Kilara, A., 1994 Whey Protein Functionality. In Protein Functionality in Food Systems. Eds. Hettarachchy, N. and Ziegler, G.R., Marcel Dekker Inc., New York

Lowry, O.H., Rosebrough, N.J., Farr, A.L., Randall, R.J., 1951. Protein Measurement With The Folin Phenol Reagent. The Journal of Biological Chemistry 193, 265-275.

Ministry of Public Health., 2000. Announcement of Ministry of Public Health (Issue 208): Cream, Gover nment gazette in General Issue. Bangkok, Thailand.

Nuraidah., 2013. Study of Artificial Meat Preparation of Red Beans (*Phaseolus vulgaris*. L). Program Food Science and Technology. Department of Agricultural Technology. Faculty of Agriculture. Hasanuddin University. Makasar

Okezie, B., Onuma., Bello, A.B., 1988. Physicochemical and Functional Properties of Winged Bean Flour and Isolate Compared with Soy Isolate. Journal of Food Science 53(2), 450-454.

O'Regan, J., Mulvihill, D.M., 2009. Preparation, Characterisation and Selected Functional Properties of Sodium Caseinate–Maltodex-Trin Conjugates. Food Chem 115, 1257–1267.

Pomeranz, Y., Meloan, C., 1978. Food Analysis Theory and Practice, Avi Publishing Company, Inc, Westport Conectcut

Pordy, W.T., 1994. Low Fat, Low Cholesterol, and Low Calorie Dairy Creamer. Carberry Corporation, assignee. U.S. Patent #5,366,751. November 22.

Prakash, N.S., Combes, M.C., Somanna, N., Lashermes, P., 2002. AFLP Analysis of Introgression In Coffee Cultivars. (*Coffea arabica* L). Derived From A Natural Interspecific Hybrid. Euphytica 124, 265–271.

Rosida, D.F., Yulistiani, R., Hafida., 2013a. Functional properties of (*Leucaena eucocephala*) protein concentrates, the results of hydrolysis enzyme bromelain. Proceedings of the National Seminar on 26-29 August 2013 PATPI Jember. Indonesia

Rosida, D.F., Sudiyarto, Hapsari, N., 2013b. Effectiveness of separation method to yield Seed Protein Concentrate (*Leucaena eucocephala*). Proceedings of the National Seminar LPPM UPN "Veteran" Jawa-Timur. Surabaya, on 10-11 Desember 2013

Rosida, D.F., Yulistiani, R., Ardiani, W., Happyanto, D.C., 2015. Production of Leucaena Seed Rotein Concentrate by Using Hydrolase Enzymes from The Rumen of Sheep. Wulfenia Journal 22(9), (Inpress)

Safitri, F., Yunianta, Purwantiningrum., 2013. Modified Starch Addition on Non Dairy Creamer Against Emulsification Stability and Efficiency Sodium Caseinate. Jurnal University of Food and Agro-industry 1(1), 1-14

Sitompul, S., 1997. Amino-acid composition of Grains and Beans . Non-Functional researchers workshop. Research Center. Ciawi

Suprapto, H.S., Sutarman, T., 1982. Planting Green Beans. PT Penebar Organissasi. Jakarta.

Suprihatin., 2009. Hydrolysis Protein From Fruit Leucaena. UNESA University Press, Surabaya

Suwarno, M., 2003. Potential Peanut lablab (*Lablab purpureus* (L.) sweet) Protein Isolates As Raw Materials. [Thesis]. Bogor: Faculty of Agricultural Technology IPB.

Wati, S.A., 2003. Purple Passion Fruit Drink Powder Formulation (Passiflora edulis f Adulis. Sims) With drying Mixing Method . [Thesis]. Dept. Food Technology and Nutrition. Faculty of Agricultural Technology. IPB. Bogor

Wuryantoro, H., Susanto, W.H., 2014. Preparation of Standard Operating Procedures Industrial Household Food Instant Sari Natural Sweetener Stevia (Stevia rebaudiana). Journal of Food and Agroindustri 2(3), 76-87